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मशीनी औजारों के लिए गति एवं भरण

(पहला पुनरीक्षण)

Indian Standard

SPEEDS AND FEEDS FOR MACHINE TOOLS

(First Revision)

ICS 25.080

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

February 1999 **Price Group 2**

Machine Tools Sectional Committee, PE 03

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Machine Tools Sectional Committee had been approved by the Production Engineering Division Council.

This standard was first issued in 1962 under the title 'Speeds for Machine Tools'. While revising this standard requirements for 'Feeds for machine tools' as laid down in IS 2219:1962 'Feeds for machine tools' have also been incorporated in this standard so as to make available a coherent and user-friendly standard to industry.

This standard is applicable to chip-removing type of machine tools driven directly by an electric motor. This is not applicable to machines with stepless speed variation, for example, the machines driven by stepless electric motors or hydraulic motors.

Speeds covered in this standard are spindle speeds per minute under load.

Feeds covered by this standard may be either the feed per minute under load when the feed mechanism is directly driven by the motor, or the feed per revolution (or per stroke) of the spindle, if it is driven by the spindle or the element providing the main cutting motion.

In preparation of this standard, considerable assistance has been derived from ISO 229:1973 'Machine tools–Speeds and feeds' issued by the International Organization for Standardization (ISO). This standard is technically equivalent to above ISO Standard.

Indian Standard
SPEEDS AND FEEDS FOR MACHINE TOOLS
(First Revision)

1 SCOPE

1.1 This standard specifies the speeds (number of revolutions or strokes per minute) and the feeds (in millimetres per minute, per revolution, or per stroke) of machine tools working by removal of metal and driven directly by an electrical motor.

1.2 This standard is not applicable, for obvious technical reasons, to machines with continuous speed variations, feeds for thread forming, etc.

2 SPEEDS

2.1 Definitions

For the purpose of this standard, the following definitions shall apply.

2.1.1 *Speed*

The spindle speed per minute under load of the spindle of the machine.

2.1.2 *Basic Value*

Value of speed which is shown on the plate of the machine and is used for calculating the machining time.

2.1.3 *Actual Value*

Value of speed which lies within the limits of the prescribed tolerances. It is conventionally calculated as follows:

$$\text{Spindle speed under load} = \text{Spindle speed without load} \times \frac{N_c}{N_v}$$

where

N_c = speed of the motor, under load, inscribed on the nameplate; and

N_v = speed of the motor measured when the machine is running without load.

2.2 Basic Values

2.2.1 The basic values for the speeds of machine tools, based on R 20 Series of Preferred Numbers, shall be as given in Table 1.

2.2.2 Table 1 may be extended, if necessary, upwards or downwards by multiplying or dividing respectively the given values by 10 or a positive integral power of 10.

2.2.3 Either the full series R 20 or any of the following derived series of R 20 series may be chosen as the complete range of basic values for the speeds of a machine tool so as to meet its requirements:

R 20/2 (....710.....), R 20/3 (.........710.......)
R 20/4 (....355.....), R 20/4 (.........710.......), and
R 20/6 (....710.....)

NOTE — In case of the derived series R 20/3 (.......710.....) and 20/6 (.....710.......) the figures (with regard to the decimal point) repeat themselves only in every fourth decimal place.

2.3 Tolerances

2.3.1 A total tolerance of +6 percent and –2 percent on the basic value of the speed shall be permitted. The total tolerance comprises electrical and mechanical tolerances which shall be as given below:

a) *Electrical tolerance* – An electrical tolerance of +3 percent and –0 percent shall be permissible.

b) *Mechanical tolerance* – A mechanical tolerance of approximately +3 percent and –2 percent shall be permissible.

2.3.2 Limits of the basic values of the speeds, calculated for the total tolerance and the mechanical tolerance, shall be as given in Table 1.

2.3.3 The allowable limits or the actual values have been determined not from the basic values of the R 20 series but from the corresponding theoretical values of the geometric series with ratio $\sqrt[20]{10}$ (values rounded-off to the first place of decimal).

3 FEEDS

3.1 For the purpose of this standard, the following definitions shall apply.

3.1.1 *Feed*

Either the feed per minute under load if the feed mechanism is directly driven by the motor, or the feed per revolution (or per stroke), if it is driven by the spindle.

3.1.2 *Basic Value*

Value of feed which is shown on the plate of the machine and is used for calculating the machining time.

Table 1 Speeds for Machine Tools in Number of Revolutions or Strokes Per Minute

(*Clauses* 2.2.1, 2.2.2 *and* 2.3.2)

Basic Value of Speed	**Limits of Speeds**			
	Corresponding to the Total Tolerance (Electrical + Mechanical) Approx + 6% −2%		Corresponding to the Mechanical Tolerance Approx + 3% −2%	
	Min	*Max*	*Min*	*Max*
(1)	(2)	(3)	(4)	(5)
100	98	106	98	103
112	110	119	110	116
125	123	133	123	130
140	138	150	138	145
160	155	168	155	163
180	174	188	174	183
200	196	212	196	206
224	219	237	219	231
250	246	266	246	259
280	276	299	276	290
315	310	335	310	326
355	348	376	348	365
400	390	422	390	410
450	438	473	438	460
500	491	531	491	516
560	551	596	551	579
630	618	669	618	650
710	694	750	694	729
800	778	842	778	818
900	873	945	873	918
1 000	980	1 060	980	1 030

NOTE – To calculate the transmission ratio of the driving equipment, the speed at the input is taken as 6% less than the synchronous speed of the motor. The quotient of the speed at the input by each of the two tabulated limits gives the extreme values of the transmission ratio.

3.1.3 *Actual Value*

Value of feed which lies within the prescribed limits of tolerances. The feed per minute is conventionally calculated as follows:

$$\text{Feed under load} = \text{feed without load} \times \frac{N_c}{N_v}$$

where

N_c = speed of the motor, under load, indicated on the nameplate; and

N_v = speed of the motor measured when the machine is running under no load.

3.1.3.1 The feed per minute or per stroke is not related to the motor.

3.2 Basic Values

3.2.1 The basic values for the feeds of machine tools, derived from R 20 series of Preferred Numbers, shall be as given in Table 2.

3.2.2 Table 2 may be extended upwards or downwards by multiplying or dividing respectively the given values of feed by 10 or a positive integral power of 10.

3.2.3 Either the full series R 20 or any of the following series may be chosen as the complete range of basic values for the feeds of a machine tool so as to meet its requirements:

R10, R5, R 20/3 (........1.......) and R 10/3 (......1......)

NOTE — In case of derived series R 20/3 and R 10/3, the figures (with due regard to the decimal point) repeat themselves only in fourth decimal place.

3.3 Tolerances

3.3.1 *Tolerance on Feed in Millimetres per Minute (Taken Independently of the Element Providing the Main Cutting Motion)*

A total tolerance of +6 percent and –2 percent shall be provided on the basic value of the feed when the feeds are expressed in millimetres per minute. This total tolerance comprises an electrical tolerance of about +3 percent and 0 percent and a mechanical tolerance of about +3 percent and –2 percent.

3.3.1.1 Limits of feeds per minute, calculated on the basis of the total tolerance of +6 percent and –2 percent shall be as given in Table 2.

3.3.2 *Tolerance on Feed in Millimetres Per Revolution or Stroke*

The feed per revolution or stroke is independent of the motor and hence only mechanical tolerance of the gear box shall be applicable to it. The limits of feeds per revolution, calculated on the basis of the mechanical tolerance of about +3% and –2% shall be as given in Table 2.

3.3.3 The allowable limits for the actual values have been determined not from the basic values of R20 series but from the corresponding theoretical values of geometric series with ratio $20\sqrt{10}$ (values rounded-off to the third place of decimal).

Table 2 Feeds for Machine Tools in Millimetres
(*Clauses* 3.2.1, 3.2.2, 3.3.1.1 *and* 3.3.2)

Basic Value of Feed	Limits of Feeds			
	Per Minute[1] +6 percent (Tolerance – 2 percent Approx)		Per Revolution or Per Stroke[2] +3 percent (Tolerance – 2 percent Approx)	
	Min	*Max*	*Min*	*Max*
(1)	(2)	(3)	(4)	(5)
1	0.98	1.06	0.98	1.03
1.12	1.10	1.19	1.10	1.16
1.25	1.23	1.33	1.23	1.30
1.4	1.38	1.50	1.38	1.45
1.6	1.55	1.68	1.55	1.63
1.8	1.74	1.88	1.74	1.83
2	1.96	2.12	1.96	2.06
2.24	2.19	2.37	2.19	2.31
2.5	2.46	2.66	2.46	2.59
2.8	2.76	2.99	2.76	2.90
3.15	3.10	3.35	3.10	3.26
3.55	3.48	3.76	3.48	3.65
4	3.90	4.22	3.90	4.10
4.5	4.38	4.73	4.38	4.60
5	4.91	5.31	4.91	5.16
5.6	5.51	5.96	5.51	5.79
6.3	6.18	6.69	6.18	6.50
7.1	6.94	7.50	6.94	7.29
8	7.78	8.42	7.78	8.18
9	8.73	9.45	8.73	9.18
10	9.80	10.6	9.80	10.3

1) Limits given for the actual values of feeds per minute in col 2 and 3 correspond to the sum of electrical and mechanical tolerances. The mechanical tolerance is calculated for feeds per revolution from values in col 4 and 5, but, for the calculation of the transmission ratio of the driving equipment, the speed at the input is taken as 6 percent less than the synchronous speed of the motor. The quotient of the speed at the input by each of the two tabulated limits gives the extreme values of the transmission ratio.

2) Actual limits of feeds per revolution or stroke in col 4 and 5 correspond to the mechanical tolerance only since feed for revolution or stroke is independent of the motor. The resulting feed per minute which is the product of the feed per revolution or per stroke and the speed per minute may vary by the combined action of the tolerance on these two factors between +9 percent and –4 percent.

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This Indian Standard has been developed from Doc: No. PE 03 (0156).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Printed at Simco Printing Press, Delhi, India